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Review of the genus *Sericocampsomeris* Betrem, 1941 (Hymenoptera, Scoliidae) from China

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Abstract

The Chinese species of the genus *Sericocampsomeris* Betrem, 1941 are revised, based on morphology. Four species are recognised, of which one species is described as new, i.e. *Sericocampsomeris punctata* Liu & Chen, **sp. nov.**, for which we also provide molecular sequence data to supplement its identity. A key to species of *Sericocampsomeris* from China and a distribution map are provided. Furthermore, we identify *Sericocampsomeris punctata* Liu & Chen, **sp. nov.** as a pollinator of *Elaeocarpus* sp. (Elaeocarpaceae) and recognise *Leucopholis rorida* (Fabricius, 1801) as a host of *Sericocampsomeris rubromaculata* (Smith, 1855).

Key Words

Scolioidea, Oriental Region, parasitoid, pollen, taxonomy

Introduction

Scoliidae (Hymenoptera: Scoloidea) is a large-sized and widely distributed family in the superfamily Scolioidea. Scoliidae contains 560 recognised species in 43 genera belonging to two subfamilies: Proscoliinae and Scoliinae (Osten 2005). Proscoliinae contains two species that occur in the southern Palaearctic Region (Day et al. 1981). The Scoliinae occur predominantly in the tropical and subtropical regions of the world. So far, only one scoliid subfamily (Scoliinae) with two tribes (Campsomerini and Scoliini), comprising 11 genera with 59 known species have been reported from China (Liu et al. 2021a, 2021c; Taylor and Barthélémy 2021). Amongst these, species of the genus *Sericocampsomeris* Betrem, 1941 are quite conspicuous because of their large body sizes (about 23–38 mm in females) and wide distribution throughout the Oriental Region.

Sericocampsomeris is placed in the tribe Campsomerini, based on morphological and molecular evidence (Day et al. 1981; Liu et al. 2021b, 2021c). As for other genera of Campsomerini, the taxonomic history of *Sericocampsomeris* is complex. *Sericocampsomeris* was first circumscribed by Betrem (1941) as a subgenus of *Campsomeris* Lepeletier, 1838. Later, Betrem and Bradley (1972) re-examined the type species and elevated *Sericocampsomeris* to generic status. Subsequently, *Sericocampsomeris* was revised by Gupta and Jonathan (1989), who recognised nine species. *Elis bella* Bingham, 1897 was once placed in the genus *Sericocampsomeris* (Gupta & Jonathan, 2003), but was later transferred to the genus *Bellimeris* by Schulten et al. (2011). Thus, currently, nine valid species are recognised in *Sericocampsomeris* (Gupta and Jonathan 1989, 2003; Schulten et al. 2011). In China, only three species, i.e. *S. degaullei* (Betrem, 1928), *S. flavomaculata* Gupta & Jonathan, 1989 and *S. rubromaculata* (Smith, 1855) have been recorded (Liu et al. 2021a, 2021c; Taylor and Barthélémy 2021). Gupta and Jonathan (1989) subdivided *Sericocampsomeris* into three species groups (I, II and III), based mainly on the

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colouration and vestiture of male specimens. According to their groupings, *S. degaullei* and *S. rubromaculata* belong to group II and *S. flavomaculata* belongs to group III.

Species of Scoliidae are larval parasitoids of scarabaeoid beetles and pollinators of various plants (Liu et al. 2021c). Available biological data indicate that *Sericocampsomeris* species are parasitoids of melolonthids (Coleoptera: Scarabaeidae) (Thompson 1958).

In this study, we examined the species of *Sericocampsomeris* from China and discovered a new species, which we describe and illustrate herein. Furthermore, we supplement the morphological description of the new species by adding genetic sequence data and notes on its biology.

Materials and methods

Collection and identification

Fresh specimens were collected by Malaise traps (MT) set up in Hainan Province, China. The terminology used follows Betrem (1928) and Gupta and Jonathan (2003). Species of *Sericocampsomeris* have been grouped and differentiated, based on male morphology by Gupta and Jonathan (1989), which facilitated the identification of the *Sericocampsomeris* species examined in this study. Abbreviations used in the text are as follows: POL = postocellar line, OOL = ocular-ocellar line, OD = ocellar diameter; T1 = 1st tergite of metasoma, T2 = 2nd tergite of metasoma, T3 = 3rd tergite of metasoma; S1 = 1st sternite of metasoma, S2 = 2nd sternite of metasoma, S3 = 3rd sternite of metasoma. The studied specimens are deposited in the Insect Collection of South China Botanical Garden, Chinese Academy of Sciences, Guangzhou, China (**SCBG**); the Collection of College of Life and Environmental Sciences at Hunan University of Arts and Science, Changde, China (**HUAS**); and the Naturalis Biodiversity Center, Leiden, The Netherlands (**RMNH**). Apical metasomal segments were removed from male specimens to prepare the genitalia for morphological study and imaging. Multifocal colour images were made using a Nikon SMZ25 microscope with a Nikon DS-Ri 2 digital camera system, some of which (Figs 3A, B, E, F, 4A) were already published in our previous papers (Liu et al. 2021b, c). Pollen grains found on the mouthparts of scoliid wasp specimens were studied by scanning electron microscopy (SEM; Jeol JSM-6360LV, Japan). Images were then post-processed with Adobe Photoshop CS6 Extended.

DNA extraction, amplification, and sequencing

To accelerate molecular species identification of Scoliidae for future work, the "barcode" region of the mitochondrial cytochrome oxidase subunit 1 (*COI*) was amplified from the new species (described below). Two male specimens of the new species were used for DNA barcoding analysis. Genomic DNA was extracted from the right mid-leg of each specimen using the DNeasy Blood and Tissue Kit (Qiagen, Hilden, Germany), following the manufacturer's protocols. Polymerase chain reactions (PCRs) were performed using Tks Gflex™ DNA Polymerase (Takara) with the LCO1490/HCO2198 primer pair (Folmer et al. 1994) and conducted in a T100™ Thermal Cycler (Bio-Rad). Thermocycling conditions were: an initial denaturing step at 94 °C for 5 min, followed by 35 cycles of 94 °C for 30 s, 50 °C for 30 s, 72 °C for 30 s and an additional extension at 72 °C for 5 min. Amplicons were directly sequenced in both directions with forward and reverse primers on an Applied Biosystems (ABI) 3730XL by Guangzhou Tianyi Huiyuan Gene Technology Co., Ltd. (Guangzhou, China). Chromatograms were assembled with Geneious 11.0.3. The two sequences generated from this study are deposited in GenBank (accession numbers: MZ753548 and OL743115). All residual DNAs are archived (−30 °C) in the molecular laboratory of SCBG, Guangzhou, China and are available for further study upon request.

Sequence analysis and molecular species delimitation

The two sequences were blasted in BOLD (Barcode of Life Database, http://www.barcodinglife.org/index.php/IDS_OpenIdEngine) and GenBank (accessed on 3 March 2022). Sequences obtained in this study, together with those of the tribe Campsomerini analysed by Liu et al. (2021c) and one sequence of *Sericocampsomeris pseudindica* (Betrem, 1928) downloaded from GenBank (accession number: MN344627), were aligned using MAFFT v.7.470 using the G-INS-I strategy (Katoh and Standley 2013). Genetic Kimura-2 parameter (K2P) distances within and between species were calculated in MEGA 7 with pairwise deletion for gaps (Kumar et al. 2016).

For molecular species delimitation, we followed Liu et al. (2021c) and used the Automatic Barcode Gap Discovery (ABGD; Puillandre et al. 2012) and the updated Poisson tree processes model (bPTP; Zhang et al. 2013) methods. The ABGD analysis was performed on the web interface (https://bioinfo.mnhn.fr/abi/public/abgd/abgdweb.html), using the default priors, P_{min} = 0.001, P_{max} = 0.1, Steps 10 and with barcode relative gap width = 1.00. For bPTP analysis, a Maximum Likelihood (ML) tree was generated in RAxML v.8.2.10 under the GTRGAMMA evolutionary model. This analysis was performed on the bPTP web server (https://species.h-its.org/ptp/), with default parameters. *Tiphia minuta* Linden (Hymenoptera: Tiphiidae; GenBank: JN299217) and *Vespa velutina* Lepeletier (Hymenoptera: Vespidae; GenBank: KY224073) were selected as the outgroups as used by Liu et al. (2021c). The ML tree file (in newick format) is provided in Suppl. material 1.

Results

The present study generated two *COI* sequences (645 and 682 bp) of a new *Sericocampsomeris* species. When

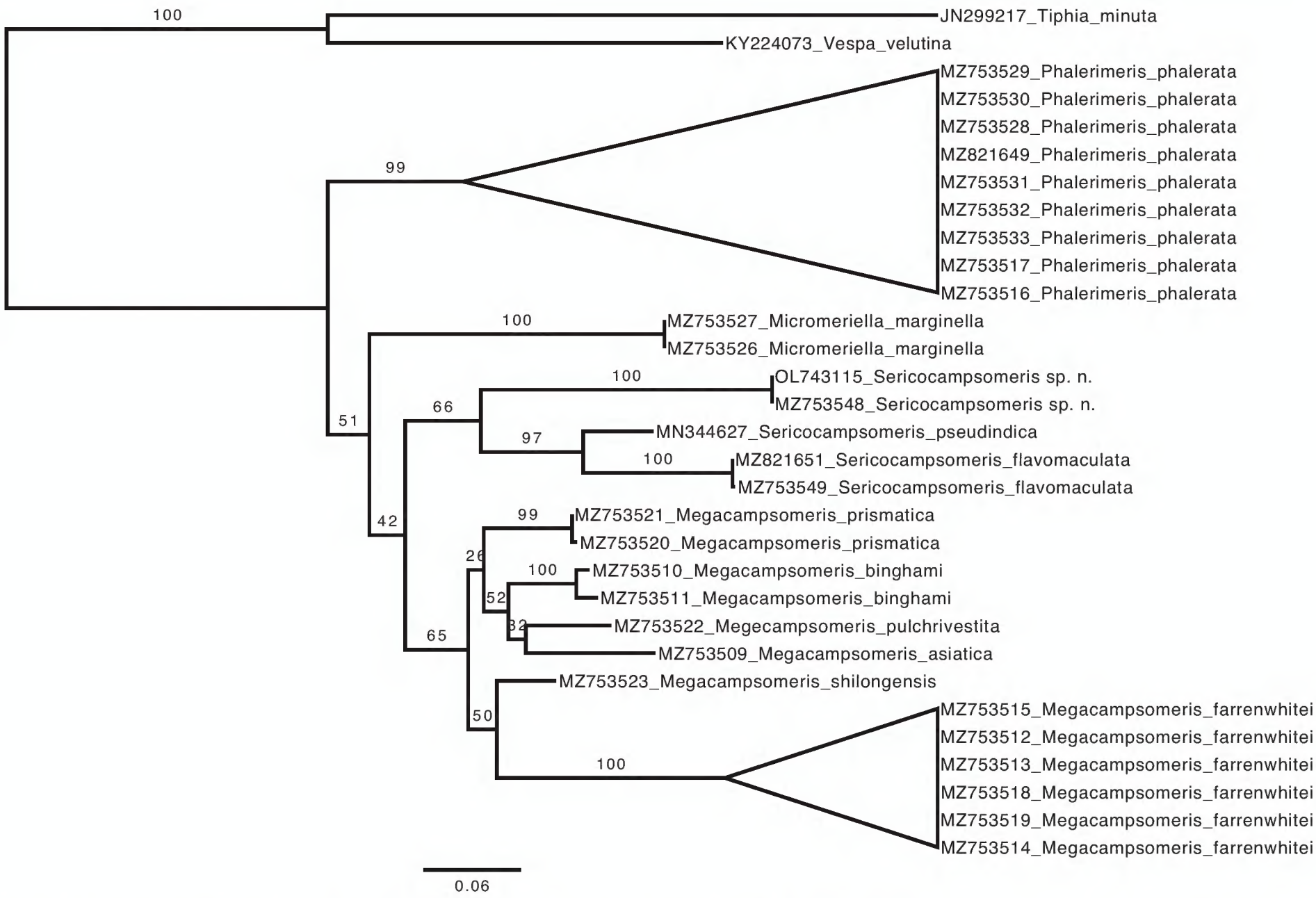

Figure 1. Maximum Likelihood tree demonstrating the clustering of Campsomerini species, based on *COI*. The numbers at nodes show the boostrap values. The scale bar represents 0.06 substitutions per site.

blasted against the BOLD and GenBank databases, no closely-matching sequences were received. Further morphological examination of the two voucher specimens indicated that they belong to an undescribed species, which we describe below. Of the three *Sericocampsomeris* species included in the molecular analyses, the new species is supported as a distinct species. The K2P distances amongst the three species ranged from 12.6% to 22.1% (Suppl. material 2). Both ABGD and bPTP species delimitation methods recovered the two voucher specimens as a distinctive species that is sister to a clade formed by *S. flavomaculata* and *S. pseudindica* (Fig. 1).

One of the six specimens of the new species contained a cluster of pollen grains on its mouthparts (Fig. 7), indicating that this wasp species acts as a pollinator. Based on pollen morphology, the plant species belongs to the genus *Elaeocarpus* (Elaeocarpaceae), although the exact species could not be determined.

Taxonomy

Sericocampsomeris Betrem, 1941

Campsomeris-subgenus *Sericocampsomeris* Betrem, 1941: 91.

Sericocampsomeris Betrem & Bradley, 1972: 12; Gupta and Jonathan 1989: 53; Gupta and Jonathan 2003: 58; Taylor and Barthélémy: 2021.

Type-species. *Scolia quadriguttulata* Burmeister, 1854 (by original designation) [= *Sericocampsomeris stygia* (Illiger, 1802)].

Diagnosis. The combination of the following characters is unique amongst all Scoliidae genera. Body length: females 23–38 mm, males 20–38 mm. Forewing with two submarginal cells and two discal cells. Tergites usually marked with large yellow or reddish-brown spots or bands. Clypeus, pronotum, scutellum, metanotum and legs also sometimes marked with yellow in male specimens. Frontal spatium densely punctate in both sexes, intervals between punctures usually smaller than the diameter of each puncture; frons moderately sparsely punctate; ventral mandibular furrow of female concealed in frontal view; hypostomal carina of male simple, without submandibular triangle. Transition between dorsal area and vertical surface of mesopleurum straight, its crest raised and sharp like a carina, especially on the lower portion; dorsal area of propodeum truncated medio-posteriorly and its posterior surface densely punctate, at least dorsally. Hind tibial spur black. Paramere of male genitalia usually rounded in middle, narrowed apicad; volsella divided into two parts, basal part with sparse to dense setae.

Biology. Thompson (1958) reported members of the genus as larval parasitoids of melolonthids (Coleoptera: Scarabaeidae): *Sericocampsomeris rubromaculata*

(Smith) parasitises *Lepidiota stigma* (Fabricius, 1798) and *S. rohweri* (Betrem) parasitises *Lepidiota pruinosa* Wiedemann, *Leucopholis irrorata* Chevrolat and *Stephanopholis philippinensis* Brenske. According to the label data of one specimen deposited in RMNH, *Leucopholis rorida* (Fabricius, 1801) is also the host of *S. rubromaculata*. In this study, we also found that *S. punctata* sp. nov. is a potential pollinator of *Elaeocarpus* sp. (Elaeocarpaceae).

Distribution. China (Guangdong, Hainan, Hong Kong, Jiangsu); India, Indonesia, Malaysia, Myanmar, Nepal, Philippines, Sri Lanka and Vietnam.

Key to species of genus *Sericocampsomeris* Betrem from China

1 Female, antenna with 12 segments (females of *S. flavomaculata* Gupta & Jonathan, 1989 and *S. punctata* Liu & Chen, sp. nov. are unknown) 2
– Male, antenna with 13 segments (male of *S. degaullei* (Betrem, 1928) not included) 3
2 Pronotum posterodorsally and upper margin of clypeus with golden setae; metasoma setae dark brown, except indistinctly reddish-brown setae on epipygium; metanotum and propodeum densely punctate ..... *S. degaullei* (Betrem, 1928)
– Pronotum posterodorsally and clypeus with black setae; setae on T2 or T5–T7 reddish-golden; metanotum and median part of propodeum largely smooth ..... *S. rubromaculata* (Smith, 1855)
3 Tergites with red or reddish maculae ..... *S. rubromaculata* (Smith, 1855)
– Tergites with yellowish maculae 4
4 Scapula with yellow maculae; T1–T5 with wide, but broadly interrupted yellow bands; paramere covered with black pubescence in ventral view ..... *S. flavomaculata* Gupta & Jonathan, 1989
– Scapula without yellow maculae; yellow bands on T1–T4 excavated medially, not totally interrupted, T5 without yellow macula; paramere covered with yellow pubescence ..... *S. punctata* Liu & Chen, sp. nov.

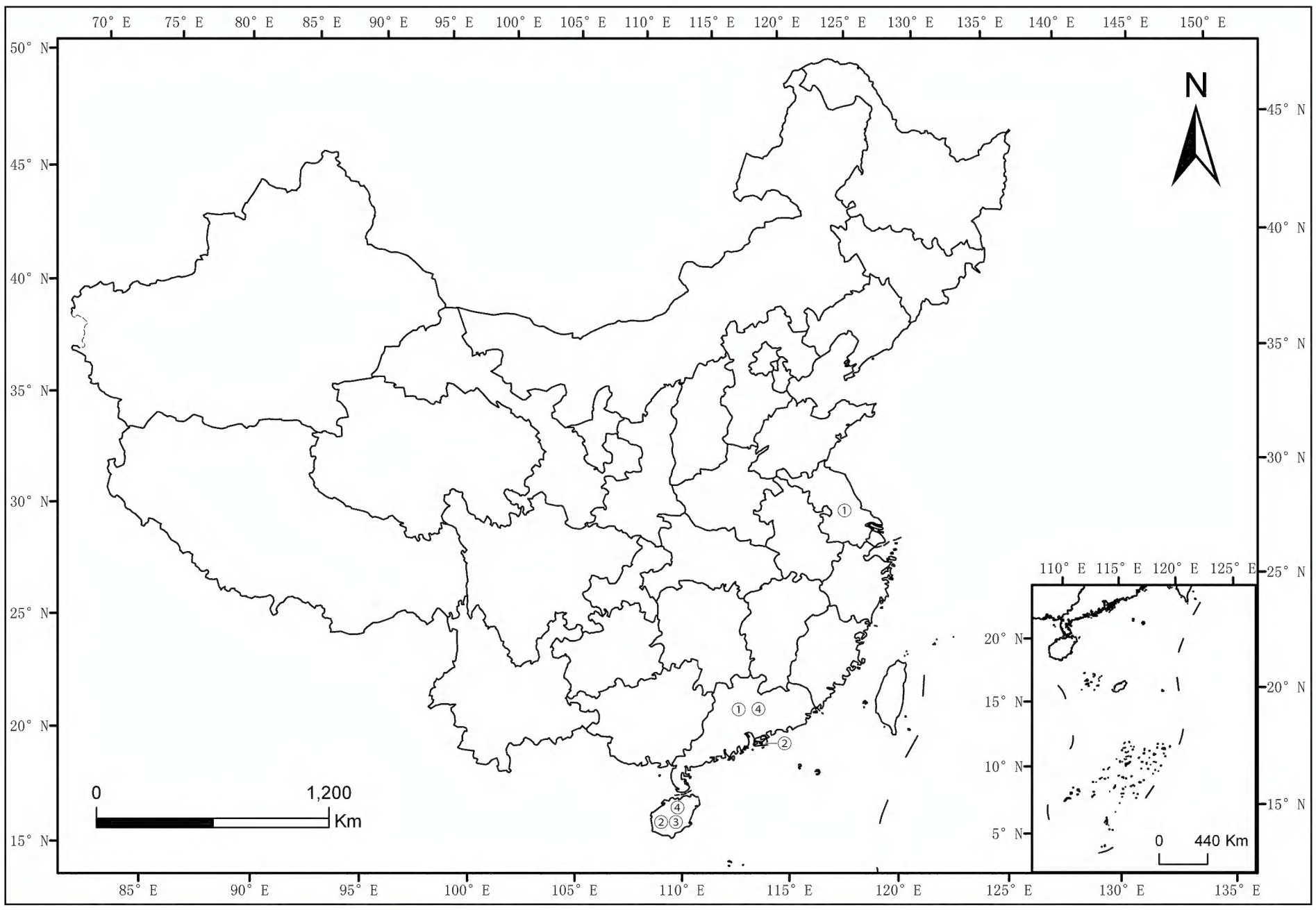

Figure 2. Distribution map of *Sericocampsomeris* Betrem in China. ① *Sericocampsomeris degaullei* (Betrem, 1928); ② *Sericocampsomeris flavomaculata* Gupta & Jonathan, 1989; ③ *Sericocampsomeris punctata* Liu & Chen, sp. nov.; ④ *Sericocampsomeris rubromaculata* (Smith, 1855).

Sericocampsomeris degaullei (Betrem, 1928)

Fig. 3A

Campsomeris degaullei Betrem, 1928: 121, ♀, Vietnam (types in Paris Museum); Hua 2006: 301.

Campsomeris (*Sericocampsomeris*) *degaullei*: Betrem, 1941: 93.

Campsomeris (*Sericocampsomeris*) *degaullei rubropilosa*: Betrem, 1941: 93.

Sericocampsomeris degaullei Betrem in Betrem & Bradley, 1972: 12; Betrem in Bradley 1974: 425; Gupta and Jonathan 1989: 55; Liu et al. 2021a: 111; Liu et al. 2021b: 159.

Material examined. ***Paratype*** (RMNH). 1♀: label 1 "Museum Paris//TONKIM CENTR.// Env. De TUY-EN-QUAN//A. WEISS 1901", label 2 "*Campsomeris degaullei*// Paratype//des Betrem".

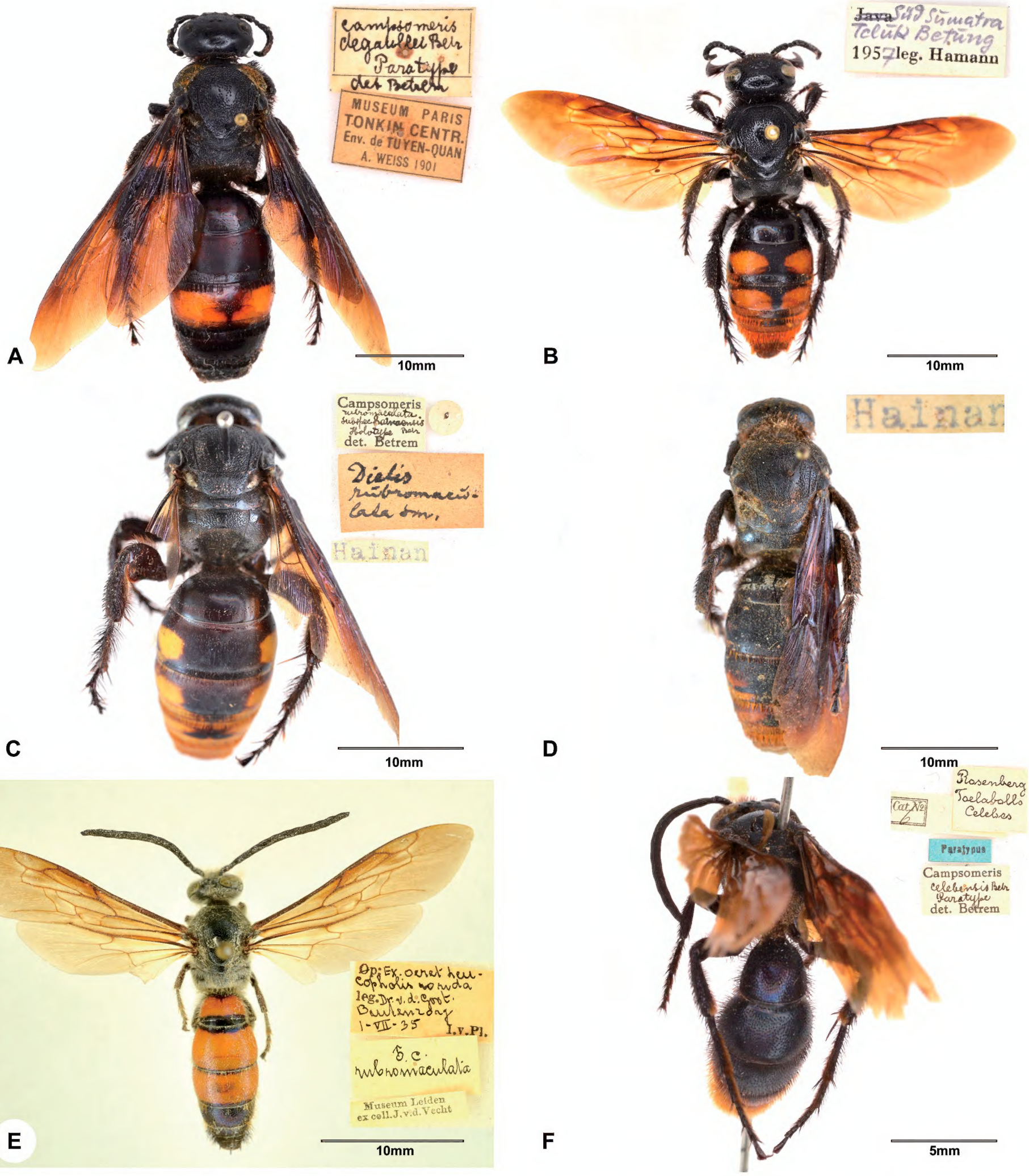

Figure 3. A. *Sericocampsomeris degaullei* (Betrem, 1928), paratype, female; **B.** *Sericocampsomeris rubromaculata* (Smith, 1855), female; **C.** *Sericocampsomeris rubromaculata hainanensis* (Betrem, 1928), holotype, female; **D.** *Sericocampsomeris rubromaculata hainanensis* (Betrem, 1928), female; **E.** *Sericocampsomeris rubromaculata* (Smith, 1855), male; **F.** *Sericocampsomeris rubromaculata celebensis* (Betrem, 1928), paratype, male. (**A, B, E** and **F** from Liu et al. 2021b; all specimens are deposited in RMNH).

Diagnosis. Females of *S. degaullei* are unique amongst all members of the genus by showing the following combination of characters: body black, except T3 almost completely bright reddish-yellow. T2 and line behind the subapical row of punctures on T4 sometimes bright reddish-yellow. Hairy, vestiture black, except scrobe, upper margin of clypeus and pronotum posterodorsally with golden brown setae, metasoma with dark brown setae and epipygium with indistinctly reddish-brown setae in female. Vertex and frons almost completely smooth, with a few shallow punctures. Mesoscutum deeply and coarsely punctate, except sparsely punctate medially. Scutellum with sparse and deep punctures. Metanotum and propodeum densely punctate, interval less than one puncture diameter wide, except dorsal part of propodeum near spiracle with an almost smooth and rectangular zone; lateral panel of propodeum entirely punctate. Wings dark brown, distinctly darker anteriorly.

Biology. Unknown.

Distribution. China (Guangdong, Jiangsu); Vietnam.

Remarks. Little is known about the male of this species. We can only find the description of a male specimen which might belong to its subspecies *rubropilosa* in Betrem (1941: 94), who provides the following description: black, T2 and T3 almost entirely yellow; vestiture black; the wings like female (means hyaline), except a little smoky. From his remarks, that male specimen has exactly the same colour as *S. rubromaculata* (originally known as *Campsomeris bicolor* Sauss.) and its allies. Additionally, from the conclusion of Gupta and Jonathan (1989), the male of *S. degaullei* shares colour patterns (integument black; usually some of the tergites with red or reddish-yellow bands or spots, sometimes entirely red or yellow; vestiture predominantly black or white, setae on the coloured areas red or reddish-brown) with the males of *S. rubromaculata*, but they did not mention any distinctive characters. Unfortunately, we could not find any other related details or specimens for the questioned male of *S. degaullei*. Additional specimens and DNA data are required to confirm its identity.

Sericocampsomeris flavomaculata Gupta & Jonathan, 1989

Figs 4A–H, 5A, B

Sericocampsomeris flavomaculata Gupta & Jonathan, 1989: 53. (holotype and four paratypes in Z.S.I., Calcutta; one paratype in Ottawa Museum). Gupta and Jonathan 2003: 61; Liu et al. 2021c: 14; Taylor and Barthélémy: 2021.

Material examined. Five males, China: Hainan, Wenchang, coconut garden, 19°32'56.61"N, 110°47'28.82"E, 19 m alt., 30.IX–10.X.2019, Malaise trap, Chun-Yang Xu, (SCBG); 5 males. Same data as above (HUAS).

Diagnosis. Males of *S. flavomaculata* Gupta & Jonathan, 1989 can be distinguished from their congeners mainly by the following characters: T1–T5 with wide, but broadly interrupted yellow bands; vestiture predominantly white; clypeus, scutellum, metanotum and legs entirely black; and paramere with black pubescence basally.

Female. Unknown.

Biology. Unknown.

Distribution. China (Hainan, Hong Kong); India, Nepal.

Sericocampsomeris punctata Liu & Chen, sp. nov.

https://zoobank.org/AEF9226D-9C8E-4D83-B068-6354DA118496

Figs 5C, D, 6A–H

Material examined. ***Holotype,*** male, China: Hainan, Wanning, Xinglong Tropical Botanical Garden, 18°43'52"N, 110°11'30"E, 8.IV–8.V.2020, Malaise trap, Zheng Wang, En-418590 (deposited in SCBG). ***Paratypes*****:** 2 males, same data as holotype, but 3.III–8.IV.2020 (HUAS). One male, same data as holotype, but 8.V–8.VI.2020, SCAU3043663 (SCBG); 1 male, China: Hainan, Wanning, Xinglong, 18°43'56.87"N, 110°11'40.47"E, 31.III–14.IV.2020, Malaise trap, Chun-Yang Xu, En-418593 (SCBG); 1 male, China: Hainan, Wanning, Xinglong, 18°43'54.22"N, 110°11'33.62"E, 15–30.V.2020, Malaise trap, Chun-Yang Xu, En-418592 (SCBG); 2 males. Same data as holotype, but 3.III–8.IV.2020 (HUAS).

Diagnosis. According to Gupta and Jonathan (1989), this new species can be classified into group III (including *S. stygia* and *S. flavomaculata*), with integument black, T1–T4 with yellow bands and vestiture predominantly white. The new species can be easily separated from *S. stygia* (distributed in Bhutan, India, Indonesia, Malaysia and Myanmar) by the black clypeus, pronotum, scutellum, metanotum and legs (all of which are more or less yellow in *S. stygia*). The new species also resembles *S. flavomaculata*, but can be distinguished from that species by the following differences: scapula without yellow macula (with yellow macula in *S. flavomaculata*); yellow bands on T1–T4 excavated medially, not interrupted, T5 without yellow macula (T1–T5 with wide yellow bands which are narrowly to widely interrupted medially in *S. flavomaculata*); punctures on mesosoma denser, nearly touching each other dorsomedially (sparser, intervals between punctures approximately equal to the width of 2–3 punctures in *S. flavomaculata*); vein 2r-m on fore-wing distinctly angled medially (slightly arched in *S. flavomaculata*); setae denser and longer on 2nd submarginal cell (sparser and shorter in *S. flavomaculata*).

Description. Male (holotype). Body length 28.2 mm, fore-wing length 21.3 mm.

Head. Distinctly wider than high in frontal view (1.4×), transverse in dorsal view, 1.1× wider than mesoscutum (between tegulae). Vertex between eye and posterior ocellus shiny and polished medially, except with sparse punctures posteriorly. Temple obscured by dense pubescence. Clypeus somewhat shiny, largely impunctate medially and basally, with coarse, dense, hairy punctures elsewhere, intervals between punctures smaller than width of a single puncture. Frontal spatium with small punctures, intervals between punctures equal to or less than the width of one puncture. Frontal fissura distinct with obvious cross-furrow. Frons sparsely punctate with intervals between punctures approximately the width of one to three punctures. Ocelli relatively large, posterior tangent

Figure 4. *Sericocampsomeris flavomaculata* Gupta & Jonathan, 1989, male (SCAU 3043664): **A.** Lateral habitus (from Liu et al. 2021c); **B.** Head, anterior view; **C.** Head, dorsal view; **D.** Head and mesosoma, dorsal view; **E.** Head and mesosoma, lateral view; **F.** Wings; **G.** Propodeum and T1, dorsal view; **H.** Metasoma, dorsal view.

Figure 5. Male genitalia. **A, B.** *Sericocampsomeris flavomaculata* Gupta & Jonathan, 1989 (SCAU 3043664); **C, D.** *Sericocampsomeris punctata* Liu & Chen, sp. nov. (En-418590); **E, F.** *Sericocampsomeris rubromaculata* (Smith, 1855). (**A, C, E** dorsal view **B, D, F** ventral view).

line of anterior ocellus not touching posterior ocelli, distance between fore- and hind ocellus slightly shorter than diameter of hind ocellus, POL:OD:OOL = 1.8:1.0:1.1. Antenna slightly shorter than head and mesosoma combined, penultimate antennomere 1.8× longer than wide.

Mesosoma. Length:width:height = 7.7:5.8:5.7. Disc of mesonotum slightly shiny, with independent punctures (intervals between punctures usually smaller than width of one puncture), without medial impunctate area. Tegula narrowly polished apically, with sparse punctures anteriorly. Scutellum less shiny with finer punctures, except with a small impunctate area dorsomedially. Metanotum with coarser punctures, intervals between punctures usually smaller than width of one puncture. Propodeum densely punctate on dorso-median area, posterior declivity and dorso-lateral area, intervals between punctures smaller than width of one puncture. Pronotal callosity coarsely punctate anteriorly, impunctate posteriorly; scapula finely evenly punctate. Mesopleuron densely punctate anteriorly, intervals between punctures equal to the width of one puncture, gradually sparser to impunctate medio-posteriorly. Upper plate of metapleuron largely polished, except irregularly punctate above, lower plate covered with obscure shallow punctures hidden in thick setae. Lateral panel of

propodeum covered with same punctures hidden in thick setae as dorso-median area; lateral carina far from spiracle level; hairy without distinct punctures on spiracular angle.

Legs. Hind femur 3.1× longer than wide. Hind coxa shiny, largely polished, except with independent punctures laterally, intervals between punctures approximately equal to the width of one to two punctures. Inner spur of hind tibia 1/4 length of hind basitarsus, outer spur 2/5. Basitarsus of hind leg 0.9× length of tarsomeres 2–4 combined, claws moderately developed.

Wings. Surface of fore-wing setose, densely so in all cells, except submedian cell, second discoidal cell and hind part of third discoidal cell nearly bare. Fore-wing with two submarginal cells and two recurrent veins. Marginal cell small, with marginal vein basally forming an acute angle with the costal. Vein 2r-m distinctly angled medially. 1st:2nd:3rd: 4th cubital vein = 1.0:1.7:1.0:1.3.

Metasoma. 2.4× longer than mesosoma. T1 with irregular punctures, becoming liner-like, becoming smaller and shallower apicad, area behind gradulus polished with whitish fringe, T4 0.8× length of T3. T2 and following tergites with minute punctures to nearly polished anteriorly and posteriorly, with coarser and denser punctures elsewhere.

Colour & vestiture. Body black, except T1–T4 and S1–S4 with yellow bands which are distinctly excavated medially. Wings dark brown, distinctly darker anteriorly and apically. Vestiture white, except apex of T5 and following tergites with black setae and setae on distal of hind tibia and each tarsal segment.

Male genitalia. Paramere robust, 2.9× longer than wide, apically tapered, hairs thin and yellow. Base of volsella covered with sparse pubescence. Squama polished in dorsal view.

Variation. Body length 26.5–28.5 mm, fore wing length 19.0–21.8 mm.

Female. Unknown.

Etymology. The specific name "*punctata*" derives from the Latin, referring to the propodeum densely punctate on dorso-median area.

Biology. Based on the examination of the pollen grains attached on the mouthparts of a specimen (En-418593, Fig. 7), this species is most likely a pollinator of *Elaeocarpus* sp. (Elaeocarpaceae).

Distribution. China (Hainan).

Sericocampsomeris rubromaculata (Smith, 1855)

Figs 3B–E, 4E, F

Scolia rubromaculata Smith, 1855: 99, ♀, India (holotype in NHMUK, London); Dalla Torre 1897: 180.

Elis (*Campsomeris*) *bicolor* de Saussure, 1858: 233.

Elis (*Dielis*) *rubromaculata*: de Saussure & Sichel, 1864: 196; Bingham 1897: 93.

Elis (*Dielis*) *bicolor* de Saussure & Sichel, 1864: 186.

Scolia bicolor: Dalla Torre, 1897: 148.

Scolia (*Elis*) *rubromaculata*: Tullgren, 1904: 468.

Campsomeris (*Dielis*) *rubromaculata rubromaculata*: Betrem, 1928: 119.

Campsomeris (*Dielis*) *rubromaculata hainanensis* Betrem, 1928: 120, ♀, Hainan (holotype in RMNH, examined).

Campsomeris (*Dielis*) *rubromaculata beharensis* Betrem, 1928: 120.

Campsomeris (*Dielis*) *bicolor* Betrem, 1928: 121.

Campsomeris rubromaculata: Betrem, 1932: 415.

Campsomeris (*Dielis*) *rubromaculata*: Betrem, 1933: 241.

Campsomeris (*Sericocampsomeris*) *rubromaculata rubromaculata*: Betrem, 1941: 95; Betrem in Bradley and Betrem 1967: 319; Jonathan 1976: 113.

Campsomeris (*Sericocampsomeris*) *rubromaculata hainanensis*: Betrem, 1941: 96.

Campsomeris (*Sericocampsomeris*) *rubromaculata celebensis*: Betrem, 1947: 414.

Campsomeris rubromaculata rubromaculata: Betrem, 1947: 414.

Sericocampsomeris rubromaculata rubromaculata: Betrem in Betrem & Bradley, 1972: 12; Betrem in Bradley 1974: 425; Gupta and Jonathan 1989: 55; Gupta and Jonathan 2003: 61.

Material examined. One female (RMNH): label 1 "Sumatra//Tclur Betung//1957, leg. Hamann"; 1 female (RMNH): label 1 "*Campsomeris rubromaculata*//det. Betrem", label 2 "MUSEUM PARIS HANOI// G. DUPOUY 1911"; 1 female (RMNH): label 1 "*Campsomeris rubromaculata subspec. hainanensis*//Holotype Betrem// det. Betrem", label 2 "*Dielis rubromaculata*", label 3 "Hainan"; 1 female (RMNH): label 1 "Hainan"; 1 male (RMNH): label 1 "On/Ex larva (= uret/white grub) of ***Leucopholis rorida* (Fabricius, 1801) (Melolonthidae)**, leg. Dr Pieter van der Goot//1-VII-35, I.v.Pl.(Instituut voor Plantenziekten = Institute for Plant Diseases)", label 2 "♂//*C. rubromaculata*", label 3 "Museum Leiden ex coll. J.v.d. Vecht"; 1 male (RMNH): label 1 "Cat No//6", label 2 "Rosenherg Joelalollo Celebes", label 3 "Paratypus", label 4 "*Campsomeris celebensis* Betrem// Paratype//det. Betrem".

Diagnosis. Females of *S. punctata* are unique amongst all members of the genus by showing the following combination of characters. Body size large (30–39 mm), black, except T2 to the following tergites and sternites with reddish-brown maculae. Hairy, vestiture black, except scrobes and frontal spatium with white setae and apical fringes and maculae on second to last tergites and sternites reddish-golden. Wings dark brown, with violet reflection. Clypeus impunctate in the middle, longitudinally striated anteromedially; frontal spatium raised and impunctate in the middle, at sides contiguously punctate; frons impunctate, except for some close punctures laterad of anterior ocellus; frontal fissura extending up to anterior ocellus, the latter in a shallow pit; vertex sparsely punctate. Mesoscutum with punctures usually separated by 0.5 to 1 puncture diameter wide, a V-shaped impunctate area present posteromedially; scutellum sparsely punctate; metanotum and median part of propodeum largely smooth.

Male. Body length 26 mm. Black, the following reddish-yellow: paired lateral spots on T1 and T2, T3 almost entirely except black along its anterior and posterior margins. Vestiture white, except on fourth and the following abdominal segments, black. Wings dark brown, forewing darker anteriorly, with golden reflection.

Figure 6. *Sericocampsomeris punctata* Liu & Chen, sp. nov., holotype, male (En-418590). **A.** Lateral habitus; **B.** Head, anterior view; **C.** Head, dorsal view; **D.** Head and mesosoma, dorsal view; **E.** Head and mesosoma, lateral view; **F.** Wings; **G.** Propodeum and T1, dorsal view; **H.** Metasoma, dorsal view.

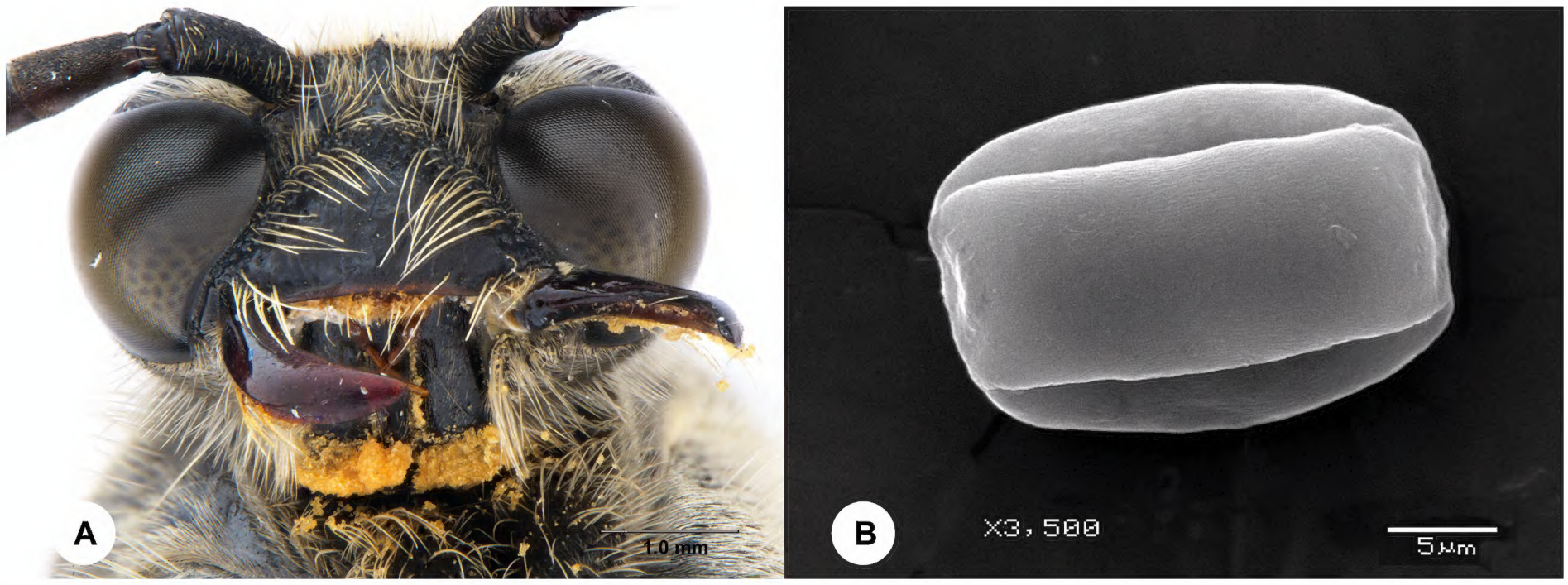

Figure 7. A. *Sericocampsomeris punctata* Liu & Chen, sp. nov., paratype, male (En-418593), mouthpart with pollens; **B.** Pollen grain of *Elaeocarpus* sp. (Elaeocarpaceae).

Distribution. China (Guangdong, Hainan); India, Indonesia, Malaysia, Myanmar and Vietnam.

Biology. *Lepidiota stigma* (Fabricius, 1798) (Coleoptera: Scarabaeidae: Melolonthinae) was listed as its host by Thompson (1958). *Leucopholis rorida* (Fabricius, 1801) is also a host record, based on the label information mentioned above.

Remarks. The female specimen collected from China (Hainan) was once designated as a subspecies of *rubromaculata* by Betrem (1928) without offering obvious differences. Gupta and Jonathan (1989, 2003) therefore ignored *hainanensis* as a subspecies. Luckily, we had the chance to examine the above specimens from Hainan (Fig. 3C, D) and Sumatra (Fig. 3B) in RMNH. Minor differences were noted: lateral spots relatively smaller (sometimes effaced on T2 and indistinct on T3 (Fig. 3D)) and more yellowish on T2 and T3 in female specimen from Hainan, while it is larger and more reddish on T2 and T3 in the specimen from Sumatra (*rubromaculata*). We also observed the male paratype specimen of the subspecies *S. r. celebensis* Betrem in RMNH. The reddish-yellow maculae are nearly effaced on T1 and T2 in *celebensis*, which is distinctly different from the nominate subspecies (Fig. 3F).

Discussion

Sexual dimorphism and cryptic species are common in the family Scoliidae. Recently, Liu et al. (2021c) demonstrated that DNA barcode-based approaches not only provide evidence of species boundaries that supplement morphological identifications, but also become invaluable means of species confirmation in some cases. In this study, we provide *COI* sequences for the new species *S. punctata* sp. nov. The association of the female of the new species could be confirmed by DNA barcoding methods in the future. Although all three *Sericocampsomeris* species form a monophyletic clade in the ML tree, the bootstrap value (66) for that clade is relatively low. More data and taxa samplings are needed to test the monophyly of the genus.

Scoliid adults of both sexes commonly visit the flowers of various plants and thus are important pollinators (Inoue and Endo 2006a, b; Campbell et al. 2016). However, there is still a lack of studies investigating the host plants of these neglected, yet important, pollinators. In this study, we show that the link between scoliid wasps and their host plants could be studied by examining the pollen grains attached on the mouthparts of the wasp specimens collected by Malaise traps.

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Supplementary material 1

ML tree file (in newick format)

Authors: Hua-Yan Chen, Zhen Liu, Zheng Wang, Sheng-Jie Yang, Shi-Xiao Luo

Data type: molecular data

Explanation note: This file contains a Newick format of the maximum likelihood tree based on the COI sequence dataset of Campsomerini species.

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Link: https://doi.org/10.3897/dez.69.83335.suppl1

Supplementary material 2

Table S1. Interspecific pairwise distance of Campsomerini based on COI sequences (%)

Authors: Hua-Yan Chen, Zhen Liu, Zheng Wang, Sheng-Jie Yang, Shi-Xiao Luo

Data type: molecular data

Explanation note: Pairwise distances of 29 COI sequences of 11 Campsomerini species.

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